Original Research Paper

Volume-7 | Issue-10 | October-2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

Neurology

ASSESMENT OF FASCICULATIONS BY ULTRASOUND IN NEUROLOGICAL DISEASE

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ABSTRACT

Introduction :
Fasciculations occurring deep within the body of a muscle are recorded using needle EMG. Neuromuscular disorders can be diagnosed using muscle USG.

Materials and methods :
Aimed to analyse the fasciculations in multiple sites by clinical, EMG and ultrasonagram and to find the usefulness of ultrasonogram in identifying fasciculations both occult and manifest. Results: Among 30 patients with history of fasciculations the number of muscles detected by clinically, EMG and myosonography was 54,61 and 90 respectively.

Discussion:
High degree of correlation was found between the EMG detection of fasciculations and Ultrasound detection of fasciculations which was statistically significant 0.024 with a p value of <0.005. USG can detect occult fasciculation which is difficult to detect by EMG.

Conclusion :
Fasciculations can be confirmed by using neuromuscular ultrasound in both clinical and subclinical situations. Painless and noninvasive Neuromuscular ultrasound by detecting the occult fasciculations enhances the diagnostic accuracy.

KEYWORDS : NEUROMUSCULAR ULTRASONOGRAM, ELECTROMYOGRAM, FASCICULATIONS

INTRODUCTION:

Fasciculations indicates the presence of a denervating disease especially those of the anterior horn cells [1]. Even normal people may have fasciculations, termed benign fasciculations because they have no associated muscle weakness or wasting[2]. 70 percent of people have fasciculations which are spontaneous yet benign[3] Fasciculations that appear on muscle surfaces are visible in clinical inspection. But those occurring deep within the body of a muscle are recorded using needle EMG. Neuromuscular disorders can be diagnosed by using muscle USG fasciculations are dynamic changes that occur in diseased muscle.

MATERIALS AND METHODS :

The aim of our study is to analyse the fasciculations in multiple sites by clinically, EMG and ultrasonagram and to find the usefulness of ultrasonogram in identifying fasciculations both occult and manifest. We included 30 patients admitted with history of fascicultions in Institute of neurology, Rajiv Gandhi government hospital,chennai. The study design is cross sectional study. The study period from Febrauary 2016 to December 2016. We included patients admitted with history of fasciculations who is on follow up and treating for neurological illness and we excluded severe disability and drug induced fasciculations. By using a proforma made by us we assessed detailed history, and clinical examination.EMG by standardized protocol (AAN), ultrasound examination of muscle using transducer of 7.5 MHZ for 30 seconds in multiple sites were studied. Correlation of clinical examination, EMG and Ultrasound was done.

Clinical evaluations of all the patients were done with a proforma that includes the following demographic profile, duration of illness, progression of the disease, proximal, distal and bulbar involvement, visual inspection of fasciculations in relaxed muscle The following investigations were done, random blood sugar, measurement of blood pressure, thyroid profile,MRI spine ,nerve conduction study.

The EMG evaluation to determine the electrical function of individual muscle motor unit potentials at rest and during muscle contraction was done for all patients. It is performed by inserting a recording needle electrode into the belly of a muscle. The needle tip is the recording electrode and the needle shaft is the reference electrode in a concentric needle.

Electrical activity from muscle fibers is recorded and amplified to appear on monitor as a tracing of voltages versus time with accompanying sound. Spontaneous activity, Motor unit action potentials (MUAPS), Interference pattern were observed and interpreted as normal, myopathic or neurogenic patterns.

Interpretation is Normal : no spontaneous activity, MUAPs with 3-4 phases,amplitude of 0.5 to 2 mV, duration of 5-15ms and a normal interference pattern. Neurogenic: spontaneous activity-present (positive sharp waves, fibrillation potentials, fasciculations, MUAPs-large amplitude, polyphasic, longer duration, interference pattern-incomplete. Myopathic: no spontaneous activity (except in myotonic dystrophy, where myotonic discharges are seen), MUAPs-normal to low amplitude, polyphasic, shorter duration, interference pattern-complete with early recruitment.

The resting potentials in more than seven sites were explored for at least 30 seconds in relaxed muscles to determine whether they were fasciculations were present or not. Fasciculations were defined as motor unit potentials, which fired in an irregular pattern.

Ultrasound examination of muscle using transducer of 7.5 MHZ for 30 seconds in multiple sites were studied. Fasciculations were observed in resting muscle.

Patients were placed in supine and prone position. USG was done in the transverse plane with a standard transducer location corresponding to the muscle belly.All the data were tabulated in Microsoft XL sheet, followed by analysis using SPSS software.

Results:

In our study of 30 patients with fasciculations the minimum age was 18 and the maximum age was 65 yrs. In this study of 30 patients male population was predominantly affected with 80% and frequency of 20 whereas females were remaining 20% and frequency of 10.

Fasciculations was predominantly seen in Deltoid muscle followed by biceps. Other areas were fasciculations observed are chest wall, shoulder area and back muscles. Para spinal area was the least amount of fasciculations detected.

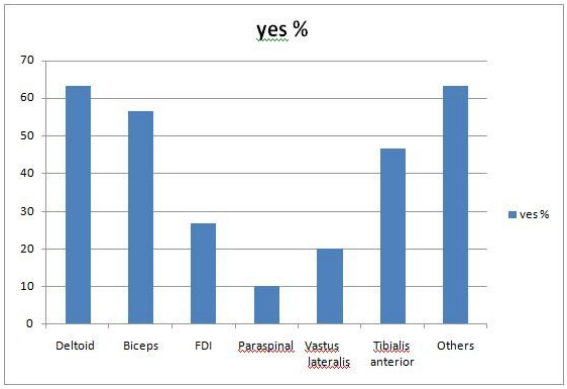

Fig1: Fasciculations identified among muscles.

Wasting of muscles was noted in 76 percent of the muscles examined. Wasting was predominantly noted in distal muscles of both upper and lower limbs. Fasciculations was frequently noted in wasted muscles. Amyotrophic lateral Sclerosis patient presented with fasciculations commonly followed by benign fasciculation syndrome (BFS) and brachial amyotrophy. Least common was postpolio syndrome and MMNCB. 70 percent has progression of the disease whereas 30 percent disease was static.

Diagnosis	Frequency	Percent
ALS	15	50.0
BFS	3	10.0
Brachial amyotrophy	3	10.0
Radiculopathy	3	10.0
Hyperthyroid	2	6.7
Madras MND	1	3.3
MMNCB	2	6.7
Postpolio syndrome	1	3.3
Total	30	100.0

Table 1: Association of fasciculations with various disease

In our study of 30 patients with fasciculations 76 percent of them had proximal wasting. Distal muscle wasting was present in 66 percent.26 percent of the patients had bulbar involvement. ALS patients had bulbar symptoms and was the initial presentation in few patients. All the 30 patients were screened for thyroid profile and abnormalities were found in 23 percent. Three persons with hyperthyroid had fasciculations

DISCUSSION:

It is a muscle twitch that occurs due to the spontaneous firing of a single motor unit. They appear on the surface of the muscle as rapid fine, flickering and occasionally vermicular contraction. They are irregular in both the timing as well as location of the muscle.

It may be appropriate to perform the ultrasonographic evaluation first, as it can then be used to guide the electro diagnostic study and perhaps limit the number of electrical stimulations from nerve conduction studies and EMG needle sticks needed. Spontaneous discharge of muscle fibers occur in those muscles that are denervated. They have sharp positive waves and fibrillation potentials when these are isolated in nature found using EDX they are insufficient to diagnose a disorder with loss of axons.

Comparative study of fasciculations using clinical, EMG and ultrasonographic assessment (reimer et al) showed the effectiveness of clinical inspection, myosonography and electromyography for the detection of fasciculations which are an important clinical entity present in MND [4]. Earlier only EMG and inspection done clinically were used to detect fasciculation but at present myosonography is included with them .The comparative value of these tools of examination shown in this study. Totally 30 people were studied First step all of they were visually screened for fasciculation then EMG and myosonography was done. Fasciculations were examined in seven muscles of all persons by clinical inspection, EMG and myosonography. Fasciculations were detected at 54 sites by clinical examination out of the 210 sites examined for 30 patients. EMG detected 61 sites of fasciculation whereas Ultrasound detected 90 sites of fasciculations. The reliability of EMG and USG is higher than that of clinical inspection.. The coefficient correlation comparing clinical and EMG was 0.023 which was significant P value. The percentage of detection of fasciculations by EMG was higher than clinically. EMG has a disadvantage of pain,and interpretation by skilled persons who are trained in EMG [5]. The coefficient correlation comparing clinical and ultrasonography was 0.032 which has a significant p value. A high degree of correlation was found between the clinical and USG diagnosis of fasciculations.USG is painless and can be repeatedly used in persons with suspected ALS for follow up[6].

Comparative study involving muscle sonography and EMG (wenzel et al) [7]the prevalence of fasciculations in the 10 muscles of lower extremity were evaluated. 54 patients suffering from a variety of neuromuscular diseases were chosen, while 58 healthy people formed the control group. Screening of each muscles for 10 second by myosonography found fasciculations in 8 muscles of the control group{19%}. 41 people with disease {76%} had fasciculations in 10 muscles. Surface EMG for 10 seconds detected fasciculations in 30 patients[56%] and 5 subjects of [9%] of the control group.

In a 20 minute recording time 55 control subjects {95%} and all the patients were found to have fasciculations. But artifacts were common in surface EMG and less in USG. So myosonography was accurate in 79%. Convenience and reliability of muscle USG over surface EMG is proven.

In our study of 30 patients EMG was compared with myosonography in the detection of fasciculations. The correlation coefficient between EMG and USG was 0.024. High degree of correlation was found between the EMG detection of fasciculations and Ultrasound detection of fasciculations which was statistically significant with a p value of <0.005. USG detected more percent of fasciculations when compared to EMG. USG is noninvasive and fasciculation can be easily detected.

In our study 3 persons had benign fasciculations and USG detected fasciculations. No cause could be found for the benign fasciculations after investigations.

USG can detect occult fasciculation which is difficult to detect by EMG. Different sites examination by EMG to search for occult fasciculations is difficult since patient may experience pain and technically difficult. But USG can be judiciously used to detect occult fasciculations . In our study of 30 patients with history of fasciculations the number of muscles detected by clinically,EMG and myosonography was 54,61 and 90 respectively. So 36 muscles with occult fasciculations were detected by USG. Many fasciculations, detected by either electromyography (EMG) or by ultrasound, are not clinically apparent, as clinical recognition depends on their proximity to the surface of the muscle, the depth below the skin, and the size of the motor unit involved. Needle EMG shows alteration of serum CPK that interferes with the diagnosis whereas neuromuscular ultrasound is noninvasive and there is non interference with CPK.

Larger muscle region are sampled using USG which have high sensitivity towards the detection of fasciculations. EMG has less sensitivity than USG in this regard because the samples are smaller. Needle EMG is a painful and inconvenient procedure while USG is an easy noninvasive and safe procedure without any inconvenience to the subjects.

Ultrasound may be slightly more sensitive than EMG at detecting fasciculations, probably because it samples a larger muscle region than needle EMG, but it can sometimes be difficult on ultrasound to detect fasciculations in patients who are unable to completely relax.

Conclusion:

Neuromuscular ultrasound is a useful technique in neurology especially in confirmation of fasciculations in both clinical and subclinical situations. The utility of neuromuscular ultrasound in detecting occult fasciculations enables diagnostic accuracy of anterior horn cell disease. It is comparable to needle EMG in detecting fasciculations. Hence Neuromuscular ultrasound is a non invasive, painless tool for utility in the evaluation of fasciculations.

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